

## I. Abstract

We propose high resolution measurements of kaon electroproduction to investigate hypernuclear states for the  $^4\text{He}$  and  $^{12}\text{C}$  targets. The proposed experiments will provide information on the  $\Lambda\text{N}$  spin-orbit interaction, bound  $\Sigma$  hypernuclei and short range correlation. Excitation of unnatural parity states will rapidly expand hypernuclear spectroscopy. The establishment of the experimental technique for light hypernuclei production will be extremely useful for the study of the deep hole states in heavy nuclei.

## II. Introduction

Hypernuclear states have been studied by the  $(\text{K}^-, \pi^-)$ ,  $(\pi^+, \text{K}^+)$  and stopped K reactions. Each reaction has different characteristics. The  $(\text{K}^-, \pi^-)$  reaction at small angles is a process with small momentum transfer. In this case it preferentially populates substitutional hypernuclear states in which a nucleon is replaced by a  $\Lambda$  particle. This transition is characterized by an orbital angular momentum transfer of  $\Delta L=0$ . The  $(\pi^+, \text{K}^+)$  reaction favors the formation of high spin states due to large momentum transfer. The stopped K reaction is a special case of the  $(\text{K}^-, \pi^-)$  reaction where the kaon is captured at rest. In this reaction variety of hypernuclear states is populated by a sizable momentum transfer.

For the  $\Lambda$  hypernuclei up to  $^{89}\text{Y}$ , the binding energies of the single particle state of the  $\Lambda$  were obtained by the  $(\pi^+, \text{K}^+)$  experiments at BNL<sup>1</sup>. On the other hand for the  $\Sigma$  hypernuclei, many candidates for narrow  $\Sigma$  states in the continuum in light nuclei have been found, but not confirmed as the  $\Sigma$  hypernuclei<sup>2</sup>. Recently evidence of a bound  $\Sigma$  state for  $A=4$  was reported<sup>3</sup>. However the hypernuclear production so far reported have been done with a poor energy resolution of  $\sim 3\text{MeV}$ . Thus, it is highly desirable to study the hypernuclear states by another probe with much higher resolution.

The  $(e, e' \text{K}^+)$  and  $(\gamma, \text{K}^+)$  reactions are expected to provide a useful alternative to the  $(\pi^+, \text{K}^+)$  and  $(\text{K}^-, \pi^-)$  reactions. The  $(e, e' \text{K}^+)$  reaction is similar to  $(\pi^+, \text{K}^+)$  reaction in regard to variable momentum transfer, but the former has some advantages for studying deeply-bound  $\Lambda$  orbits. The electrons are very weakly absorbed in compared with the pions. In addition the  $(e, e' \text{K}^+)$  reaction excites both natural and unnatural parity hypernuclear states with comparable strength. Although many theoretical predictions have been carried out for hypernuclear production by the  $(e, e' \text{K}^+)$  and  $(\gamma, \text{K}^+)$  reactions, no experimental data have been reported up to the present. Recently  $^{12}\text{C}(\gamma, \text{K}^+)^{12}\text{B}$  measurements have been successfully performed at INS<sup>4</sup>.